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#26
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63-11607A

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Ungchusri et al.

Serial No.: 08/742,520 — Art Unit: 3616

Filed: November 1, 1996 — Examiner: H. Shackelford

For STEP BEARING RACE SWIVEL JOINT ASSEMBLY

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APPLICANT'S APPEAL BRIEF

Further to the Notice of Appeal filed on August 24, 1998, applicant hereby submits this Appeal Brief, in triplicate, in the above-captioned matter.

Please charge the $310.00 fee required under §1.17(f) to PTO Deposit Account No. 06-1440. A duplicate copy of this paper is attached for accounting purposes.

(1) Real Party in Interest:

The real party in interest is the assignee, FMC Corporation.

(2) Related Appeals and Interferences:

Applicant is not aware of any related appeals or interferences which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims:

Claims 1, 4, 5 and 12-23 are pending in the instant application. Claims 13-17 have been allowed. Claims 1, 4, 5, 12 and 18-23 stand finally rejected, and it is the rejection of these claims that is hereby appealed.

(4) Status of Amendments:

No amendments to the claims have been filed subsequent to the final rejection dated May 29, 1998.

(5) Summary of Invention:

The present invention relates to a swivel joint for rotationally joining two fluid conduits. Typical swivel joints, including applicants' own prior art swivel joint, include interfitting male and female connectors, a number of bearing races defined by cooperating annular grooves formed on the respective outer and inner surfaces of the male and female connectors, and a plurality of ball bearings received in the bearing races to rotationally connect the male and female connectors together. The respective adjoining surfaces of the male and female connectors are of constant diameter, and the bearing races are therefore located at the same radius from the centerline of the swivel joint. Furthermore, a

seal is usually provided to seal the interior juncture between the male and female connectors.

In severe service applications, the fluid flowing through the swivel joint is usually under high pressure. This high pressure creates hydrostatic end loading which tends to force the male and female connectors apart and thereby results in brinelling or deformation of the bearing races. This in turn relaxes the compression of the seal and causes the seal to leak.

Applicants have attempted to solve this problem by providing a swivel joint having "stepped" bearing races, that is, a plurality of bearing races wherein the radius of each bearing race is greater than the radius of the adjacent bearing race closer to the interior juncture of the male and female connectors. Applicants have discovered that this stepped configuration helps to more evenly distribute the hydrostatic end load to all the bearing races and thereby reduce brinelling of the bearing races.

With respect to independent claims 1 and 19, therefore, and with reference to Figure 2 of the application, the invention is directed to a swivel joint (110) which comprises a male connector (112) having a portion which is received within a female connector (114) and rotationally connected thereto by a plurality of ball bearings (124). The male and female connectors each include a plurality of annular grooves (118, 120) formed on the respective adjoining outer and inner surfaces thereof which, when the male connector is received within the female connector, align to form a like number of bearing races (122) for the ball

bearings. In addition, the radius of each annular groove as measured from the centerline (126) is greater than the radius of the adjacent annular groove closer to the interior juncture of the male and female connectors. (See page 3, line 30 through page 4, line 13 of the description.) This results in the stepped configuration of the bearing races.

Independent claim 20 and claim 22 (which depends from claim 19) are similar to claims 1 and 19 but include an additional requirement of a seal (128) positioned at the interior juncture of the male and female connectors. Claims 21 and 23 (which depend from claims 1 and 19, respectively) include the additional requirement that the male and female members include recessed inner annular portions (130, 132) which form a recessed groove (134) for the seal. (See page 4, lines 21-31 of the description.) Finally, claims 12 and 18 (which depend from claim 1) include the additional requirement of a straight line segment (425) located at the apex (422) of each inner or the outer annular groove. As explained on page 5, line 30 through page 6, line 6 of the description, this straight line segment allows the annular grooves to be formed with substantially the same radius as the ball bearings, while facilitating assembly of the swivel joint. This in turn maximizes the contact areas between the grooves and the ball bearings to thereby minimize brinelling.

(6) Issues:

I. Whether claims 1, 12, 18-20 and 22 are unpatentable under 35 U.S.C. §103 as being obvious over Phillips (U.S. Patent No. 2,412,287) or

Ashton (U.S. Patent No. 3,372,715) or applicants' admitted prior art Figure 1, in view of Himes (U.S. Patent No. 1,452,603).

II. Whether claims 4, 5, 21 and 23 are unpatentable under 35 U.S.C. §103 as being obvious over Phillips or Ashton or applicants' admitted prior art Figure 1, in view of Himes and Tauber, Jr. et al (U.S. Patent No. 5,149,148).

(7) Grouping of Claims:

For each ground of rejection, applicant concedes to the grouping of the claims.

(8) Argument:

I.

Claims 1, 12, 18-20 and 22 stand rejected under 35 U.S.C. §103 as being unpatentable over Phillips (U.S. Patent No. 2,412,287) or Ashton (U.S. Patent No. 3,372,715) or applicants' admitted prior art Figure 1, in view of Himes (U.S. Patent No. 1,452,603).

In formulating the subject obviousness rejection, the Examiner has improperly combined Himes with Phillips and Ashton and applicants' Figure 1. Himes is not analogous with applicants' invention. Moreover, assuming arguendo that Himes is analogous, no motivation exists in the prior art to combine Himes with Phillips or Ashton or applicants' Figure 1.

The Federal Circuit has promulgated a two step test for determining whether a particular reference is analogous to the applicant's invention: (1) whether the reference is from the same field of endeavor, regardless of the

problem addressed; and (2) if the reference is not within the inventor's field of endeavor, whether the reference still is reasonably pertinent to the particular problem with which the inventor is involved. See In re Clay, 23 USPQ2d 1058, 1060 (Fed. Cir. 1992).

There can be no doubt that Himes is not from the same field of endeavor as applicants' present invention. Applicant's invention is directed to swivel joints for coupling fluid conducting pipes which are used in, for example, the petroleum industry. Himes, on the other hand, concerns bearing assemblies for machine tools in which the parts are running at high speeds, or where excessive loads occur, or where the spindle is required to operate with accuracy (see page 1, lines 46-58 of Himes). Thus, applicants' field of endeavor is fluid handling equipment, whereas Himes' field of endeavor is machine tools. Therefore, in the present case, Himes fails the first step of the Federal Circuit's test.

Addressing the second step of this test, Himes also is clearly not reasonably pertinent to the particular problem with which the applicants are involved. Applicants' inventive swivel joint addresses the problem of the deformation or brinelling of the ball races in high pressure applications (see page 1, lines 16-21 of the application). The speed of rotation of the swivel joint is not an issue, because these joints are typically rotated manually. To the contrary, Himes specifically addresses the problem of seizing or chatter in high speed applications (see page 1, lines20-29 and 59-81 of Himes). Furthermore, applicants' swivel joint and Himes' machine tool are not structurally similar.

Applicants' swivel joint connects hollow tubulars, while Himes' bearing assembly supports a solid spindle. These differences weigh against a finding of analogy. See In re Clay 23 USPQ2d at 1061. In short, a person having ordinary skill in the art of designing fluid handling equipment would not reasonably have expected to solve the problem of ball race deformation or brinelling by considering a reference dealing with eliminating seizing and chatter in high-speed bearing assemblies.

Thus, Himes is not analogous to applicants' field of invention. Therefore, the rejection of claims 1, 12, 18-20 and 22 over Phillips or Ashton or applicants' Figure 1 in view of Himes should be reversed.

Moreover, no motivation exists in any of the references cited by the Examiner, or the prior art in general, to combine Himes with Phillips or Ashton or applicants' Figure 1. According to the Federal Circuit:

> There must be some reason, suggestion, or motivation found in the prior art whereby a person of ordinary skill in the field of the invention would make the combination. That knowledge can not come from the applicant's invention itself.

In re Oetiker, 24 USPQ2d 1443, 1446 (Fed. Cir. 1992). In the present case, nothing in the prior art would suggest applying the stepped bearing configuration of Himes with the fluid handling swivels of either Phillips or Ashton or applicants' Figure 1.

No motivation exists in the cited references for the combination asserted by the Examiner. In Phillips, the purpose of the ball bearing means 13, 14 is simply to rotationally connect end sections 11, 12 with the body 10 (column 1, lines 37-42). Indeed, Phillips relates to a hose reel for connecting a multiple of hoses, and there is no mention in Phillips of any limitations with the bearing means 13, 14 in achieving this general purpose. Moreover, Phillips does not mention any high speed applications of his hose reel that could result in problems with the bearing means 13, 14 similar to those discussed by Himes. Therefore, one of ordinary skill in the fluid handling art would not be motivated to use the bearing arrangement of Himes in Phillips. Similarly, the fluid loading arm assembly of Ashton employs several swivel assemblies for connecting individual conduits, and it is apparent that these swivel joints are not subjected to high rotational speeds that could result in problems similar to those discussed by Himes. Therefore, one of ordinary skill in the fluid handling art would not be motivated to use the bearing arrangement of Himes in Ashton. Likewise, applicants' Figure 1 shows a fluid swivel joint that is not subject to high rotational speeds and is therefore not concerned with the problems of seizing or chatter which Himes addresses. Therefore, one of ordinary skill in the fluid handling art would not be motivated to use the bearing arrangement of Himes in the swivel joint of Figure 1.

Furthermore, nothing in the prior art suggests the general superiority of a stepped bearing configuration, such as disclosed in Himes, for fluid swivel joints.

While the Examiner cites Hoffman, Badger, Rohn and GB 15,984 for the proposition that the stepped bearing configuration is commonly used in a variety of applications (see the Office Action dated May 29, 1998, page 5, line 20 through page 6, line 2), these references all relate to devices having solid shafts, not hollow fluid swivel joints. Moreover, given the issue dates of Himes (1921), Phillips (1943) and Ashton (1963), one can only conclude that, if motivation did exist to combine the bearing arrangement of Himes with fluid swivel joints, such combination surely would have occurred prior to the instant application.

Moreover, Himes actually teaches away from the objective of applicants' invention. As discussed above, the goal of applicants' swivel joint is to reduce brinelling of the bearing races in the presence of hydrostatic end loading in order to maintain the seal between the male and female members. Thus, applicants desire to maintain the male and female connectors in a fixed relative position. In Himes, if the members 30, 31 are considered the male connectors and the members 18, 19 are considered the female connectors, any pressure acting between these members would be allowed to force these members apart (see column 2, lines 40-50). Thus, any seal between the male and female connectors would be relaxed and would leak. Therefore, one seeking to solve the problem which applicants' invention addresses would not be inclined to rely on Himes.

Thus, it is apparent that the combination of Himes with either Phillips or Ashton or applicants' Figure 1 is not suggested by the prior art. Therefore, the

rejection of claims 1, 12, 18-20 and 22 over Phillips or Ashton or applicants' Figure 1 in view of Himes should be reversed.

II.

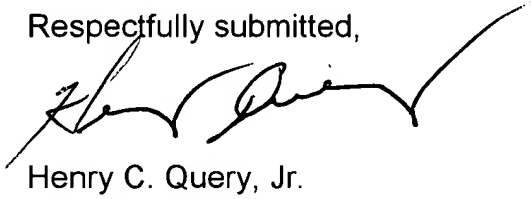
Claims 4, 5, 21 and 23 stand rejected under 35 U.S.C. §103 as being unpatentable over Phillips or Ashton or applicants' admitted prior art Figure 1, in view of Himes and Tauber, Jr. et al (U.S. Patent No. 5,149,148).

The basis for this rejection is essentially the same as for the rejection of claims 1, 12, 18-20 and 22 discussed above. As discussed above, the Examiner's combination of Himes with Phillips and Ashton and applicants' Figure 1 is improper. Therefore, the present rejection is improper and should be reversed.

Conclusion

For the foregoing reasons, it is submitted that claims 1, 4, 5, 12 and 18-23 are patentable. Favorable action is solicited.

Respectfully submitted,



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Appendix

1. In combination with a swivel joint forming a flow passage and having a central axis, the improvement comprising:

a hollow tubular male connector having a first end, an annular outer surface and a plurality of outer annular grooves formed on said outer surface concentric with said central axis, wherein each said outer groove comprises a generally arcuate cross-section and a radius measured from said central axis, and wherein the radius of each said outer groove is greater than the radius of each adjacent outer groove closer to said first end;

a hollow tubular female connector having an annular recess adapted to receive and fit around said outer surface and a plurality of inner annular grooves formed on said annular recess concentric with said central axis, said recess forming a shoulder within said female connector adjacent said first end, wherein each said inner groove comprises a generally arcuate cross-section and a radius measured from said central axis, and wherein the radius of each said inner groove is greater than the radius of each adjacent inner groove closer to said shoulder, said inner grooves each corresponding to one of said outer grooves and forming therewith an arcuate race; and

a plurality of ball bearings received in each race to secure said male and female connectors together and to facilitate relative rotation of said male and female connectors about said central axis.

4. A swivel joint according to claim 21, wherein

said seal is made of a non-metallic material.

5. A swivel joint according to claim 4, wherein

said seal is a radial compression fit seal.

12. A bearing assembly according to claim 1, wherein

each said inner groove has a section located at the apex of the generally arcuate cross-section comprising a straight line segment.

18. A bearing assembly according to claim 1, wherein

each said outer groove has a section located at the apex of the

19. A swivel joint comprising:

a central axis;

a hollow tubular male connector having an outer annular surface, a first end and at least first and second outer annular grooves formed on the outer surface concentric with the central axis;

a hollow tubular female connector having an inner annular recess forming an inner annular shoulder and at least first and second inner annular grooves formed on the inner recess concentric with the central axis;

wherein the inner recess is adapted to receive and overlap the outer surface such that the first end is adjacent the inner annular shoulder and each inner groove is in alignment with a corresponding outer groove to thereby define at least first and second arcuate races;

wherein the diameter of each arcuate race is greater than the diameter of each adjacent arcuate race closer to the first end of the male connector; and

a plurality of ball bearings received in each race to secure said male and female connectors together and to facilitate relative rotation of the male and female connectors about the central axis;

wherein the male and female connectors form a flow passage of the swivel joint.

20. A swivel joint comprising:

a central axis;

a hollow tubular male connector having an annular outer surface and a first end;

a hollow tubular female connector having an annular recess adapted to rotatably receive the outer surface and the first end; and

at least first and second annular bearing means located between the outer surface and the recess to facilitate rotation of the male and female connectors about the central axis;

wherein the diameter of each bearing means is larger than the diameter of each adjacent bearing means closer to the first end of the male connector; and

means positioned between the first end and the annular recess to seal between the male and female connectors;

wherein the male and female connectors form a flow passage of the swivel joint.

21. A swivel joint according to claim 1, wherein:

said first end of said male connector comprises a recessed inner annular portion;

said female connector comprises a recessed inner annular portion adjacent to said male connector recessed inner annular portion when said male connector is received in said female connector, such that said recessed inner annular portions of said male and female connectors together form an inner annular seal groove; and

said swivel joint further comprises an annular seal having an outer sealing surface received in said seal groove thereby sealing against the inner circumferential surfaces of said recessed inner annular portions of said male and female connectors, said seal having an inner surface generally flush with said flow passage.

22. A swivel joint according to claim 19, further comprising:

an annular seal positioned between the first end and the inner annular shoulder.

23. A swivel joint according to claim 19, further comprising:

a first recessed section formed in the male connector adjacent the first end and a second recessed section formed in the female connector adjacent the inner annular shoulder, the first and second recessed sections forming a

recessed groove when the male connector is received in the female connector; and

an annular seal positioned within the recessed groove.